

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/GB2004/002535

International filing date (day/month/year)
11.06.2004

Priority date (day/month/year)
12.06.2003

International Patent Classification (IPC) or both national classification and IPC
H01S3/063, H01S3/067

Applicant
SOUTHAMPTON PHOTONICS LTD

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☒ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ in written format
 - ☐ in computer readable form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in computer readable form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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Box No. II Priority

1. ☒ The following document has not been furnished:

☒ copy of the earlier application whose priority has been claimed (Rule 43bis.1 and 66.7(a)).

☐ translation of the earlier application whose priority has been claimed (Rule 43bis.1 and 66.7(b)).

Consequently it has not been possible to consider the validity of the priority claim. This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43bis.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)

Yes: Claims 5,9-11,12,14,18,22-33
No: Claims 1-4,6-8,13,15-17,19-21,34

Inventive step (IS)

Yes: Claims 12,14,30-33
No: Claims 5,9-11,18,22-29

Industrial applicability (IA)

Yes: Claims 1-34
No: Claims

2. Citations and explanations

see separate sheet

Box No. VI Certain documents cited

1. Certain published documents (Rules 43bis.1 and 70.10)

and /or

2. Non-written disclosures (Rules 43bis.1 and 70.9)

see form 210

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Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

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Re Item VI: Certain documents cited

Certain published documents

Application No Patent No	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
US 2003 210 725 A	2003-11-13	2003-06-06	2001-03-14
US 6 587 496 B	2003-07-01	2000-12-11	2000-12-11

Re Item V: Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1: US 6 324 326
D2: US 2003 0 636 29 A

- 1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of **claim 1** is not new in the sense of Article 33(2) PCT.
 - 1.1 The cited document **D1** discloses (see abstract; column 3, line 44 - column 4, line 3; column 5, line 63 - column 6, line 53; column 10, lines 15 - 62 and Fig. 7) :
 - i. apparatus (waveguide laser) for providing optical radiation, which apparatus comprises
 - ii. a pump source (diode laser) for providing pump radiation, and
 - iii. a brightness converter (120),
 - iv. the apparatus being characterized in that the brightness converter contains a substantially rigid region (substrate (124), waveguide (120)) along at least a portion of its length (whole length).

Therefore the subject-matter of claim 1 is anticipated by document **D1**.
 - 1.2 Also document **D2** (see par. [144] - [148] and Fig. 16) anticipates the subject-matter of claim 1.
- 2 Dependent claims 2 - 4, 6 - 8, 13, 15 - 17, 19 - 21 and 34 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty.

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2.1 Claims 2, 13, 15 - 17, 19 and 34

The brightness converter of **D1** further provides a core ((120); see column 10, lines 30 - 32), first cladding (see column 10, lines 32 - 34), rare earth dopants (Yb^{3+} or Nd^{3+} ; see column 11, lines 17 - 28), a first end (multi-mode section (126)) and a second end (single-mode section (130) of Fig. 7), as required by claims 2, 16 and 17. The device further comprises a single core section (120) with a non-circular shape, as required by claims 13 and 15, and consists of a waveguide laser, as required by claims 19 and 34.

2.2 Claims 3 and 4

The waveguide (120) of **D1** comprises a tapered region (128) located between the first and second ends, the cross-section of the first multi-mode section (126) is greater than that of the second single-mode section ((130) in Fig. 7) and the waveguide is made of a rigid material (see column 10, lines 22 - 28), as required by claim 3. **D1** further discloses that the pump radiation is coupled from the pump diode laser to the brightness converter using a coupling means (the entrance face (132)), as required by claim 4.

2.3 Claim 6 - 8

Although **D1** does not explicitly state that the brightness converter of Fig. 7 has a first reflector for reflecting optical radiation emerging from the first end and a second reflector, this is implicitly disclosed, since the structure of Fig. 7 is a waveguide laser (see column 3, lines 44 - 46). Thus **D1** anticipates the subject-matter of claims 6 and 7. The device of Fig. 7 is pumped by a diode laser (see column 10, lines 53 - 60), as required by claim 8.

2.4 Claims 20 and 21

The brightness converter known from **D1** is used to pump an erbium-doped fiber amplifier (see column 4, lines 4 - 7), i.e. a waveguide, as required by claim 20. Further, the device shown in Fig. 7 of **D1** has a width of 100 μm (see column 10, line 65 - column 11, line 1), as required by claim 21.

3 Dependent **claims 5, 9 - 11, 18 and 22 - 29** do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of the inventive step.

3.1 Claim 5

D1 discloses the use of a lens to couple the pump light from the laser diode (72) into the brightness converter (30) in the fiber laser of Fig. 4 (see column 8, lines 27 - 42). Since **D1** teaches that the waveguide laser of Fig. 7 can be used instead of the fiber laser of Fig. 2 - 6, it would be obvious for the skilled person to use a lens for the device of Fig. 7 and thus obtain the subject-matter of claim 5.

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3.2 Claims 9 - 11

The use of a solid-state laser, arc lamp or flashlamp for pumping a waveguide laser lies within the routine experience of a skilled person, who would thus add this feature to the device of documents **D1** or **D2**, according to the circumstances, and thus arrive at the subject-matter of claim 9 without the use of any inventive skills. **D1** further discloses, in relation to the prior art, the use of multiple pump sources, combined by using WDM-technology (see column 2, lines 5 - 6). As these techniques are also widely used in the art, it would be obvious for the skilled person to add them to the device of **D1** and thus obtain the subject-matter of claims 10 and 11.

3.3 Claim 18

The use of a second cladding in a planar structure as that of Fig. 7 in **D1** lies within the routine experience of a skilled person, who would add this feature to the device of **D1**, according to the circumstances, and thus arrive at the subject-matter of claim 18 without the use of any inventive skills.

3.4 Claims 22 - 29

The physical dimensions defined in claims 22 - 29 lie within the ranges commonly used for waveguide lasers as that of **D1**. Therefore the skilled person would add these features to the device of **D1**, according to the circumstances, and thus arrive at the subject-matter of claims 22 - 29 without the use of any inventive skills.

- 4 The combination of the features of dependent **claims 12, 14 and 30 - 33** is neither known from, nor rendered obvious by, the available prior art.

Re Item VII: Certain defects in the international application

The features of the claims 1 - 34 are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

Regarding the description and figures, it should be noted that, according to the requirements of Rule 11.13(m) PCT, the same feature shall be denoted by the same reference sign throughout the application. This requirement is not met in view of the use of reference signs (171), (172) and (173) in Fig. 16 and 17 (see also the description on page 21).

Re Item VIII: Certain observations on the international application

The application does not meet the requirements of Article 6 PCT, because **claims 1, 3 and 19** are not clear.

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The expression "substantially rigid" used in claims 1 and 3 is vague and unclear and leaves the reader in doubt as to the meaning of the technical features to which it refers, thereby rendering the definition of the subject-matter of said claims unclear.

Claim 19 refers to a "waveguide" which has not been defined in any of the preceding claims (missing antecedent), therefore the claim is unclear.